

REMARKS:

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-24 are presently active in this case, Claims 1-2, 4-6, and 9-14 amended and Claims 23-24 added by way of the present amendment.

In the outstanding Office Action, Claims 4, 6, and 9-12 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1-6, 8-9 and 12-15 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,711,849 to Flamm et al.; Claims 1-4 and 10-15 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,232,134 to Farber et al.; Claims 7 and 10-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Flamm et al. in view of U.S. Patent No. 5,658,423 to Angell et al.; Claims 16-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Flamm et al. in view of U.S. Patent No. 5,601,869 to Scott et al.; and Claims 16-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Farber et al. in view of Scott et al.

First, Applicants wish to thank Examiner Berman and Primary Examiner Nguyen for the November 13, 2008 personal at which time the outstanding issues in this case were discussed. During the discussion, Applicants presented amendments and arguments substantially as indicated in this response. In particular, Applicants explained that conversion of scan data such as that shown in Figures 6A and 7A, into spectral data of the spatial components, as shown in Figures 6B and 7B, allows for easier identification of subtle changes in a process parameter. While no agreement was reached, the Examiners indicated that clarification of this feature in Claims 1 and 14 may overcome the outstanding rejection.

With regard to the rejection under 35 U.S.C. § 112, second paragraph, Claims 4, 6 and 9-12 have been amended to correct the informalities noted in the outstanding Office Action.

Therefore, the rejection under § 112, second paragraph, is believed to be overcome. Further, the claims have been amended to correct discovered informalities and to clarify the invention.

Specifically, Claims 1 and 14 have been amended to recite that characterizing includes “measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature.” Thus, the claims now recite that the spatial components are “spatial components in spectral space,” and the “measured signature includes the at least one spatial component in spectral space” and is compared to a reference signal. Paragraphs 62-64 and Figures 6A, 6B, and 7A, 7B of Applicants’ specification explain that the spatial components in spectral space result for example, from applying a discrete Fourier transform to the measured scan data to convert the data to spatial components in spectral (Fourier) space.

Claims 1 and 14 have also been amended to recite that the difference signature “represents a difference between the measured signature and reference signature.” Paragraphs 87-90 and Figures 18B, 18C and 18D explain the difference signature in relation to a measured signature and reference signature.

Claim 5 has been amended to recite that “said transforming comprises applying a discrete Fourier transform to the measured data to provide a plurality of spatial components as Fourier harmonics.” Paragraph 62 explains that when using a Fourier series representation of the data, the spatial components can be Fourier harmonics.

Claim 10 has been amended to recite that “optimizing comprises improving spatial uniformity of said measurement data.” This is described in paragraph 86 and Figure 17 of Applicants’ specification, which explain that an adjustment in etch process provides a uniform scan of etch rate data reflecting uniform process results.

Claim 11 has been amended to recite that “optimizing comprises minimizing a magnitude of said at least one spatial component in spectral space.” This is described in paragraphs 66 and 67 and Figures 10A and 10B of Applicants’ specification, which explain that uniformity of a process is directly correlated to reducing the magnitude of spatial components in spectral space. Paragraph 84 of Applicants’ specification also explains the desire to reduce the magnitude of spatial components in spectral space. Thus, the claim amendments do not raise an issue of new matter.

Thus, independent Claims 1 and 14 now clearly recite:

- (1) measuring a process performance parameter at a plurality of positions on a sample,
- (2) transforming the measurement data into spatial components in spectral space, and
- (3) the measurement signature includes at least one of the spatial components in spectral space, and is compared to a reference signature.

As discussed in Applicants’ specification, and in particular paragraphs 61-64 and Figures 6A, 6B, 7A, and 7B, converting the measured data to spatial components in spectral space (by discrete Fourier transform, for example) allows detection of subtle changes in uniformity profile across the substrate for a given process.

In contrast, the cited reference to Flamm et al. discloses a method of designing a reactor by chemically etching a top film surface to define a physical profile 27 on the film as shown in Figure 1A. This physical profile is then analyzed to determine a concentration profile, and changes to the process chamber and/or process parameters are made in order to effect changes in another physical etch profile. Through this iterative process, the plasma chamber design can be optimized. However, as discussed in the November 13th interview, Flamm et al. does not disclose any conversion of the physical etch profile or concentration

profile into spectral data representing spatial components as required by Applicants' Claims 1 and 14.

Similarly, the cited reference to Farber et al. discloses a method and apparatus for monitoring wafer characteristics based on a surface charge distribution pattern on the wafer. As discussed in the November 13 personal interview, Farber et al. discloses first obtaining an image of a surface charge distribution pattern of a wafer, and then comparing this image with a known surface charge distribution pattern correlated to desirable process results. As seen in Figures 1-4, the charge distribution pattern can include a particular configuration of lobes and rings which correlate to a problem in the performed process. However, this comparison of charge distribution images does not convert measurements into spectral data representing spatial components as required by amended independent Claims 1 and 14.

Thus, neither Flamm et al. nor Farber et al. disclose "transforming the measurement data into at least one spatial component in a spectral space to identify a measured signature of a process" or that a "measured signature comprises the at least one spatial component in spectral space," as recited in Claims 1 and 14. Further, the secondary references to Angell et al. and Scott et al. are not cited for, and in fact do not disclose, the feature missing from Flamm et al. and Farber et al.

Therefore, Applicants' independent Claims 1 and 14 patentably define over the cited references. As Claims 2-13 and 15-28 depend from 1 or 14, these claims also patentably define over the cited references. Nevertheless, Applicants have added Claims 23 and 24 to further distinguish the claimed invention over the cited references. Claims 23 and 24 recite identifying whether a process variation is global or local based on the signature of spatial components. As discussed in the November 13 interview, an example of this determination is described with respect to Figure 6B of Applicants' specification. None of the cited

references show this additional feature. Therefore, Claims 23-24 provide an additional basis for patentability over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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